A BRIEF ESSAY

ON THE

CAUSES OF DRY-ROT

IN PUBLIC AND PRIVATE SHIPS

AND

ITS REMEDY.

BY JAMES BARRON,

Of the United States' Navy.

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1829.

To the Honorable

JOHN BRANCH,

Secretary of the Navy of the United States.

Sir,

A former edition of this pamphlet was dedicated to the Honorable the Secretary of the Navy, who was at the head of that department at the time of its publication, the sole object of which was to hazard an opinion, based on the reasons and suggestions that accompanied it, upon a subject, which properly considered, I would fain hope might have a beneficial influence on the prosperity of our national and commercial marine; and with the same object in view, I now beg leave, most respectfully to recommend the present impression, with a few additional remarks, to your protection. An experiment on one ship (if it can be so called, after the proofs that have been exhibited,) will in due season, settle this important question, provided a fair selection of her timber be made.

I have the honor to be,

Sir,

Most respectfully,

Your obedient servant,

JAMES BARRON.

OF DRY-ROT AND ITS REMEDY.

The condition in which many of our public and private ships have been found, from the effects of *Dry-Rot*, has, for the last thirty years, engaged much of my particular attention, to the important desideratum for remedying the evil, and preserving this branch of our national defence and commercial marine.

There has not been, for many years, an instance of our ships proving deficient in *strength*, consequently their *durability* should be the object of our present inquiry.

After a minute investigation, aided by a long course of observation, and a familiar intercourse with scientific and practical men, I have arrived at the conclusion, that violent extremes of an impure atmosphere, are the cause of the destruction so frequently witnessed in our ships—particularly those in ordinary. Though built of the best materials, and in the best style of workmanship, it is manifest they are not exempt from that species of decay, commonly called Dry-Rot. I have, therefore, considered it a duty to communicate the result of my reflections and experience upon this subject, and the simple mode by which I would propose to obviate this deplorable evil, and at the same time effect the saving of a large amount in this branch of the public expenditure.

The importance of salubrious air in cherishing and preserving vegetable and animal life, is well known both to the scientific and practical observer of causes and effects; and the value of a pure atmosphere cannot be too highly estimated by nautical men, who, from being continually confined, in large numbers, to very close and circumscribed apartments, are most liable to disease, generated by mephitic air, the fatal consequences of which are so frequently demonstrated in all maritime expeditions.

A strong argument also, as to the deleterious properties of this air, may be drawn from the better health enjoyed by those officers who occupy apartments more remote from this noxious atmosphere, than those of the men, and where a current of pure air is continually expelling the destructive effluvia arising from the cause just mentioned.

Again, the most positive proofs of the destruction occasioned to timber by foul atmosphere, are to be seen in every ship that is found in a decayed state; the best timber connected with the interior, being more or less injured, while that, even of an inferior quality, situated on the

exterior, will be found to be comparatively sound.* A particular illustration of this truth is seen also in the excellent preservation in which the cabin furniture and joiners' work of ships, such as birth boards, &c. are found, arising from the free ventilation of those apartments, and their remoteness from the source of the noxious air generated by the bilge water. I would not be understood as ascribing this destructive agency directly to the bilge water itself, for it is well known that those parts of the timbers which are always covered with it, are seldom known to decay, while those immediately above it are most injuriously affected by the noxious air arising from it.

A variety of plans and experiments have been essayed to arrive at the important desideratum for obviating this evil; but I have heard of none that has rewarded its projector with any satisfactory result: agents of various kinds have been resorted to, without success; fire, air, water and various affinities of chymistry, have been employed, without producing any decided opinion, either as to the best means or method of obtaining the desired object.

I have now in possession a machine for ventilating ships by *fire*, and from experiments which I have made with it, I am convinced that this element is by no means so powerful an agent for the purpose, as some writers who have speculated on the subject would assume. Nor are ventilators, depending for their efficacious operation upon the motion of a ship, to be at all relied upon; for it frequently happens, that, from being in smooth water, and the prevalence of calms, they remain inoperative for months together, the impulse they receive not being sufficient to put in motion the most delicate machinery.

Our great object then should be, to discover some agent not liable to these objections, nor dependent for its operation upon any other power than one always at command, by means of which the atmosphere in every department of a ship may be kept at all times in a pure and healthful state. Now it is too evident to require illustration, that as the impure air generated by the bilge water, and secreted between the timbers of a ship, in proximity to this noxious agent, is drawn out, fresh and wholesome air from above will be substituted, (for nature knows no vacuum,) and by the frequent repetition of this operation, the whole interior of the ship will be pervaded with a pure and wholesome atmosphere, in place of that so destructive to the lives of the crew, as well as to the timbers of which the ship is constructed.

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* Eight years after the frigate United States was launched, I visited her and found all the materials unconnected with the internal air, (that is, that air between the inside and outside plank) as perfectly sound as they were when I first joined her in '98; I served on board of her for two years, and could readily identify the articles alluded to. At the time I speak of, the United States had undergone one thorough repair and was equally ready for the second.

Every ship or vessel acts, in some degree as a Hydraulic Bellows, according to the quantity of water allowed to remain in her after the pumps have sucked; for as this water, by the motion of the vessel, rolls from side to side, the air above it, is, by its motion, alternately forced out and drawn in between the timbers; and as this confined air, thus becomes necessarily mixed with pure, fresh air, the timbers are longer preserved, as far as the influence of the latter extends: hence we may infer, that if means were adopted to expel entirely the foul air, thus generated between the two skins, timbers would last much longer than if exposed, as at present, to its destructive action. That small portion of a ship's timber which is covered by the bilge water, generally remains sound, which is a proof that the foul *air* it produces is exclusively the cause of decay; since the part not exposed to its action is preserved, while all that comes within its influence is destroyed. This foul air, the effect of which is commonly called Dry-Rot, is doubtless produced by the action of the bilge water on the timber and the metals of which ships are constructed—else why do those on the stocks, under cover, and free from this water, last much longer than such as are afloat and subject to its operation? If the last fact, in addition to the one above mentioned viz: that the parts of ships not connected with the internal impure air continue sound, while those exposed to its action are destroyed, were not sufficient proof that it is the agency of the bilge water that produces the evil, an additional and perhaps conclusive proof is found in the circumstance, that if part of the very same kind of timber put into a ship, be employed in the construction of a house*, the latter remains sound, while the former hastens rapidly to decay.

It is true indeed, that vessels on the stocks, constructed of green materials, are often seen suddenly to decay; but this arises from the quantity of moisture in the timber, and the want of careful ventilation, when the external atmosphere is dry and wholesome; and the no less necessary precaution of excluding the external air when its temperature is such as to produce an injurious degree of moisture. For it is demonstrated by all experience on the subject, that an impure or moist atmosphere is no less deleterious in its effects on vegetable than on animal life. It may not be irrelevant here to observe, that the tightness of ships is a fruitful cause of the destructive atmosphere of which I am speaking; for there is not an instance of the sudden decay of a ship that has proved leaky the first three or four years

* Some objections have been made to instituting a comparison between the greater durability of timbers employed in a house than those in a ship, on account of their difference in size. I answer, that many houses in this, as well as in every other civilized country, have a considerable portion of timber in their frames as large as that of ships—viz: the steeples of churches, the beams of state and store houses, &c. none of which show any corresponding degree of decay with those of ships.

of her running; and this can only be accounted for by the continual use of her pumps, constantly admitting a quantity of pure water, and again removing it before it can become impregnated with the properties of the wood and the metalic substances, from which it derives its destructive qualities.

Having, as I conceive, established the fact, that the preservation of our ships, and the health of their crews, will be secured by providing a remedy against the destructive effects of the mephitic air generated in the hold by bilge water, I proceed to state, as the result of my experience and observation, that the use of AIR PUMPS in Summer, and AIR PUMPS and STOVES in Winter, will effectually accomplish this desirable end, provided our ships shall be constructed as hereinafter recommended.

The Air Pump I propose, is in the form of a Blacksmith's Bellows, (see plate) but may be varied in this particular, as convenience or arrangement may suggest, the principle of its operation being retained: The criterion for working it should be the state of the atmosphere below, to be determined by the proper instruments;—and by the operation of the proposed exhauster, the air below should be made to correspond constantly with that on the upper deck of the ship.

The following explanation of the plate will be found clearly to describe the properties and uses of the Pump, or Bellows:

A. The Bellows, that may be made in any form, perhaps that in common use by Blacksmiths may prove the most convenient.

B. The Deck: the Bellows may be placed on the most convenient deck; that under the lower gun deck of all ships, will be the most favorable for their preservation.

C. Communicating pipe; this pipe is to be firmly attached to the deck on which the Bellows stands, and the Bellows connected with it by an elastic leather Hose, and worked by its underside, as those in use by Blacksmiths usually are. Ships already built, may be advantageously ventilated by using only the pipe C.

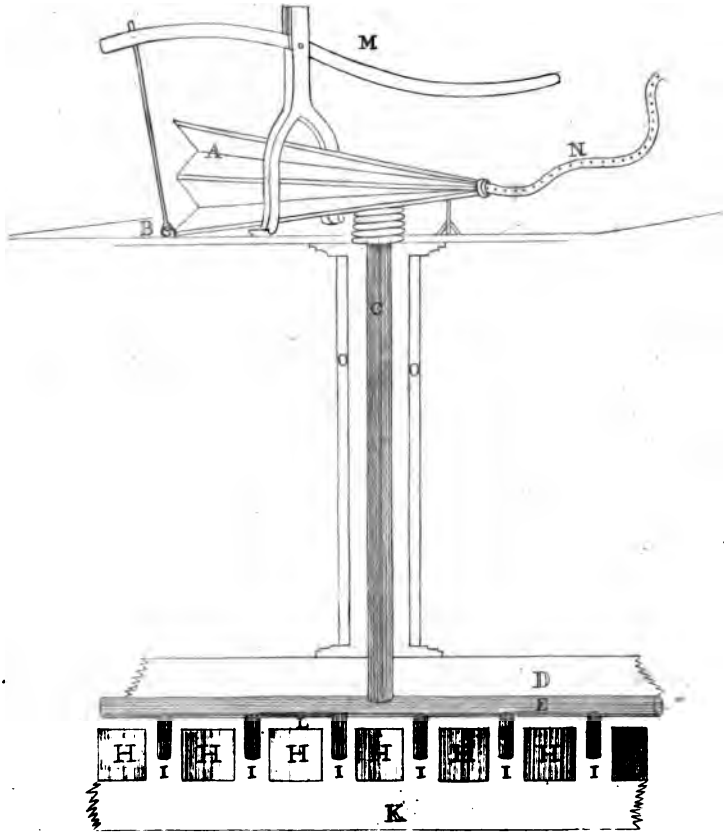
D. The Keelson; to the side of which the cylinder E. is to be secured.

E. The main Cylinder; which may be made in two, three or more pieces, according to the length of the ship, and must be closed at their ends; for it is all important to direct the whole force of the Bellows to drawing off the air from between the timbers. Of course this will constantly introduce the pure air in proportion to the quantity of foul thus expelled: the cylinder should be three or four inches in diameter.

F. Pipes leading from cylinder E. to the spaces between the timbers. These pipes pass through that part of the ceiling commonly called limber boards, as shewn in space marked L. and should not exceed two inches in diameter; all the pipes

AIR PUMP

for extricating foul Air from Ships



may be made of thick sheet copper; the cylinder E. should be made of the thickest sheet copper, securely stapled to the keelson, and covered with thick plank, capable of protecting it from the pressure of water tanks and ballast.

H. Timbers as shewn, supposing the side of the ship to be sawed off from stem to stern, by the edge of the limber boards.

I. The spaces between the timbers, where the foul air is generated that has proved so destructive to all ships since it has become the practice to ceil them so closely.

K. The keel.

L. The ceiling plank, and that part commonly called limber boards, moveable for the purpose of cleaning the lower extremities of a ship's bottom inside.

M. The lever by which the Bellows is worked, and which must be fixed to its under side.

N. Hose attached to the nozzle of the Bellows, and passed out of a port, to convey the foul air clear of the ship.

O. Half stanchions grooved, to receive and protect the communicating pipe.

I will here mention, as a proof of the efficacious operation of the above described ventilator, that a small quantity of any odour, deposited in the hold of a ship, will, by the power of this machine, be brought in a few seconds, to the deck on which it is placed.

OF THE BUILDING OF SHIPS.

In the preceding pages I have intimated, that in order to the beneficial operation of the Air-Pump or Bellows, and to prevent the secretion of the destructive air, which the machine is intended to extract, ships should undergo a considerable change in their construction.

I have submitted my ideas on this subject to several of our most celebrated mechanics, all of whom concur with me in the opinion, that a change may be made in the manner of constructing our ships, without the least risk of impairing their strength; for, although there will be a much smaller quantity of materials employed than in those heretofore built, yet, from the combination of these materials, the ships will be stronger than when, as now, loaded with metals and timbers, which rot in a few years. This superabundance of metal and timber occasions ships to swim too deep, and in a great measure destroys the invaluable quality of buoyancy; while the unnecessary pre-

caution of closely ceiling ships, with a view of giving to them additional strength, is, I again urge, one of the principal causes of their rapid decay.*

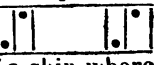
A very important advantage would accrue to the merchant service, from the proposed change in the construction of ships, whereby a free ventilation would be afforded to the *cargoes*, which, especially when in bulk, or composed of articles making close stowage, are liable to great damage from being over-heated. This evil is almost inseparable from a *tight* ship, which, as before observed, generates a foul air, destructive to every thing that comes in contact with it; and it has been distinctly ascertained, that less injury would be done to cargoes of grain and other articles, stowed in bulk, in leaky than in tight ships; the latter not being so susceptible of ventilation. A great benefit would also result to the *crews*, from the better state of preservation in which the *provisions* of ships would be kept, by this improvement in their ventilation.

Formerly, when ships were built in Virginia, (for the merchant service,) of the common oak of the country, and not so closely connected in their timbers or ceiling as at present, it was not uncommon to see them from sixteen to twenty years old before they had undergone any material repair; but lamentable to relate, we now seldom see a ship, either public or private, that is not more or less rotten in from five to seven years after she is built. The question may then reasonably be asked, what nation can support a navy, if its ships are to be rebuilt in so short a time after their construction?

Again, if the quantity of timber used in the construction of ships, both public and private, is under any circumstances, necessary, how are we to account for the latter performing long voyages, through tempestuous oceans, loaded with heavy cargoes, without complaining either by straining or leaking; when, on examination, they are found to be so rotten as scarcely to exhibit one entire sound plank or timber; and, but for the superior quality of the live-oak, of which our national ships are principally framed, they would be in the same situation? The fact above stated, of the competency of our private ships to sustain the strain of heavy cargoes, even in the decayed condition represented, certainly goes to prove, that more timber is employed in the contruction of our public ships than is necessary for the purposes of strength alone; and regard to the valuable quality of buoyancy, should furnish a strong reason for not lumbering them with snperfluous materials. It is an incontrovertible fact, that merchant ships have encountered the heaviest gales while in the condition above stated, without exhi-

* In the year 1805, Col. Lear informed me, that he visited the frigate *Crescent* in Algiers—she was then about seven years old, and built of the common oak of New-England. On examining her, he found that her ceiling had been taken out; and the Minister of Marine informed him, that to this cause they attributed the duration of their ships.

biting the slightest sign of weakness. Public ships, when so loaded with timber, float too deep in the water, either for comfort or fast sailing. The practice too of ceiling the decks over head, for ornament sake, is also ruinous to the beams and deck plank itself, while it so much increases the weight in timber, of which I complain.

All national vessels should be built with copper bolts, wherever they can be introduced, to be secured by *screw* taps on their inner ends, and removed or replaced at pleasure when a ship is repaired; and by no means should the present practice of cutting out plank and breaking off bolts be allowed; being a great waste of time and often of valuable materials. If ships were built in the manner here recommended, the strakes of plank might be removed or replaced with convenience, without an additional hole being bored in the frame. It might probably become necessary, in this case, to use bolts one size larger in repairing, as driving out the bolts might somewhat enlarge the hole. I should recommend one bolt in each edge of the plank to pass through each timber composing the frame thus  and not to use tree-nails or spikes at all, in any part of a ship where they can be dispensed with. Thus constructed, ships can be completely ventilated, and when they require repairs, they may be taken asunder with perfect ease, and in a manner to expose every part of their frame to view, by which plan no defect can be concealed or rendered difficult to remove.

Again, ships should be built in regular frames, coaged or dowelled together, and strongly bolted, from the floors to the top timbers.—These frames should be placed from eight to twelve inches apart, (according to the size of the ship;) the ceiling as far up from the keelson, as one or two strakes above the floor heads, may be flush, and then chamfered pieces, (a term used by carpenters for horizontal pieces of plank) perforated with many small, smooth holes, let in between the timbers—covering the openings between the ceiling and outside plank, to admit the fresh air, as fast as the foul is pumped out by ventilators; the ceiling should then be partial up to the strake below the clamps of the lower gun-deck; using only three strakes of ceiling of from eight to twelve inches wide (according to the size of the ship) over each joining of the timbers. The ceiling should be of plank one third thicker than that commonly used, and the frame let into it fully that third, thereby forming a kind of jog and chock work, on the principle of a square, supported from the point of each angle thus  which renders the whole frame more secure than a general ceiling in the manner now practised. On each gun deck a strake, or a small part of one, should be left out, and the openings furnished with shutters, hung by hinges, or metal slides, opposite each aperture between the frames, for the purposes of ventilation: to be closed in time of ac-

tion, or during violent weather. On this plan it is evident ships would be much lighter, contain less time and other costly materials; would also be sufficiently strong, and show at the first glance that they must be more healthy, as there would be scarcely a place in them where foul air could be secreted.

OF STORE ROOMS, &C.

The whole system of bulk-heads and partitions for store rooms might also be changed for a more open and airy arrangement, all tending to remedy the evil complained of, by admitting a free and unobstructed current of air into every department of the ship, alike promotive of the health of the crews, the preservation of the ships, and of the valuable materials in charge of the store-keepers. Stanchions and shelves would answer all the purpose of dividing the different articles, and one *general store-keeper*, better qualified than those to whom such service has heretofore been assigned, would suffice to supervise the whole distribution of the stores.

OF THE MAGAZINES OF SHIPS.

The Magazine of every ship should be as distinct from the Hull as convenience will permit. It should form a box, supported on all sides by stanchions, and made perfectly tight, so that in case of fire, it might be overflowed by water, introduced by a pipe passing through the sides of the ship into the box, without connexion with any other part of the ship's hold. An excellent idea has lately been suggested, for guarding against accidents, in conveying powder on board of ships, as well as against the awfully destructive effects of an explosion in the magazine. The plan is this, to have canisters of copper, with screw tops, made water tight, capable of containing from sixteen to twenty rounds of cartridges. Under such circumstances, should a fire occur on board, the magazine might be immediately filled with water, without detriment to the powder; and the ship might burn to the water's edge and fill, before an explosion would be likely to take place.

Another highly important advantage of this plan, is the increased effect given to the exertions of the crew, by removing all apprehension of her blowing up; the alarm from which, has on several occasions proved destructive to that discipline, which otherwise might have been effectual in saving the ship.

OF THE PUMPS OF SHIPS.

I cannot but look back with astonishment at the listlessness that has prevailed in the nautical world, for such a length of time, in allowing so great a quantity of water to remain in a ship, after the pumps have sucked. This water, commonly called bilge water, is also a principal cause of a ship's decay, and of the unhealthiness of the crews; notwithstanding which, it is yet the custom to allow, from six inches to two feet of this poisonous water to remain in a ship, under the idea that it would be dangerous to let the pumps have a closer connexion with the seams of the garboard strake, lest they should draw out the oakum from those seams so nearly connected with them. The best reason that could be assigned for not allowing the pumps to descend lower, or to the outer plank of the bottom, commonly called the skin, is that ships are now built much stronger than heretofore, and of course from the close connexion of the floor timbers, there is not room for the pumps to enter between them; consequently the depth of the floor timbers determines the quantity of bilge water, allowed to remain in a ship. This inconvenience might be removed by having one or more *small* pumps placed farther aft, and let so close down to the inner part of the outward skin, as to take this water up within an inch of the bottom. I will suppose that the close connexion of the floor timbers—or a better reason than the one assigned, namely, that when further removed from any obstruction, the water naturally flows more freely to their heels or entrance—has been the cause of the pumps' not being let down nearer to the bottom of a ship. But this reason can have no manner of influence, nor be properly urged as an objection to allowing one or two small pumps to go down within one inch of the bottom, only to be used in drawing this fetid water entirely out of the ship, after those placed at a greater distance from the bottom have sucked, and thereby to extract the last drop of this poisonous cause of death and destruction.

time, and I suppose that is the only reason why it has not yet been sufficiently tested to put the matter at rest. But let it be cut at whatever season it may, or treated in the best possible manner known, I will venture to predict, that if it is put into a ship, built as closely as is now the practice, that it will share the same fate, which has been its common lot for the last thirty years. Water seasoning is highly approved of by many practical men, but that method, also, appears to want some well attested experimental evidence to entitle it to general credit.

It should be recollected that within the last thirty years, great havoc has been made in the forests of this country,—timber, consequently, has become scarce, and dear,—hence, we may infer, as the natural result, that inferior qualities are forced into the markets, and of course, the inspection should be commensurate with the exigencies caused by those circumstances.